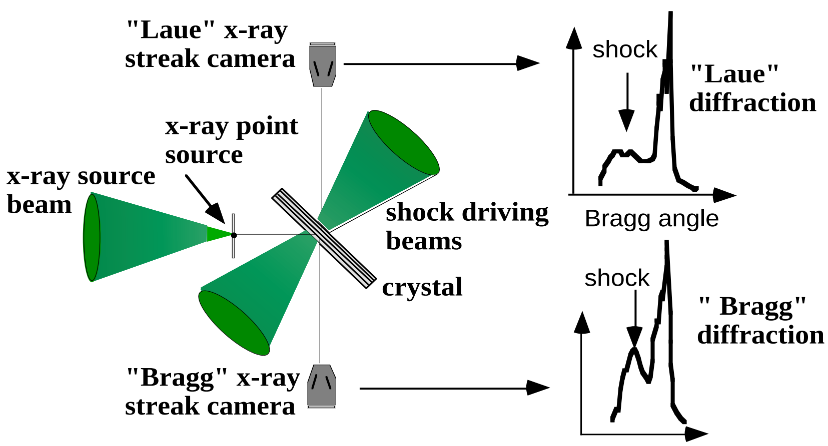
Los Alamos
Inertial Confinement Fusion

November 1997 Progress Report

Target Physics:

Material Characterization:

In a collaborative effort with Oxford University and Lawrence Livermore National Laboratory, we have been developing transient x-ray diffraction as a diagnostic method for phenomena such as materials phase changes and direct drive imprint. Diffraction from crystalline material can provide a real time measurement of strain in material subjected to a shock wave. In our present work, we have demonstrated for the first time simultaneous diffraction from two orthogonal planes. A shock wave propagating through condensed matter will produce uniaxial strain along the shock propagation as long as the material is responding elastically. If the shock is beyond the yield point there can be a plastic component to the material response. This configuration provides a method for measuring both elastic and plastic components of the response of the material. An example of this data is shown. The “Bragg” diffraction is from planes perpendicular to the shock wave excited by the shock driving beams. The “Laue” diffraction is from planes orthogonal to the shock.



NIF Target Design:

Capsules with copper-doped beryllium ablators have long been considered as alternatives to bromine-doped plastic ablator capsules for the National Ignition Facility. Both capsules contain similar gaseous DT fuel and a solid DT fuel layer inside the ablator. The superior performance of beryllium is becoming well substantiated. Beryllium capsules have the advantages of relative insensitivity to instability growth, low opacity, high tensile strength, and high thermal conductivity. 2-D LASNEX results indicate particular beryllium ablator capsule designs are several times less sensitive than the plastic ablator point design to instability growth from solid DT interface’s roughness. These beryllium ablator designs contain more ablator mass and hence leave some beryllium unablated at ignition. By adjusting the level of copper dopant, the unablated mass can increase or decrease, with a corresponding decrease or increase in sensitivity to instabilities. Beryllium’s low opacity causes it to absorb more energy and permits the creation of 250 eV capsule designs. Its high tensile strength allows it to contain DT fuel at room temperature. Its high thermal conductivity simplifies cryogenic fielding. These results were presented at the November 1997 APS meeting, and are submitted for publication in the ***Physics of Plasmas.***